A.7 Swainson's Hawk (*Buteo swainsoni*)

A.7.1 Legal Status

The Swainson's hawk (*Buteo swainsoni*) is listed as a threatened species under the California Endangered Species Act (Fish and Game Code, Sections 2050 et seq.). The species was listed by the California Fish and Game Commission in 1983.

The Swainson's hawk has no federal regulatory status. However, the species is included on the U.S. Fish and Wildlife Service list of Birds of Conservation Concern (BCC) for Region 1. BCC species are those that the USFWS considers potential candidates for federal listing.

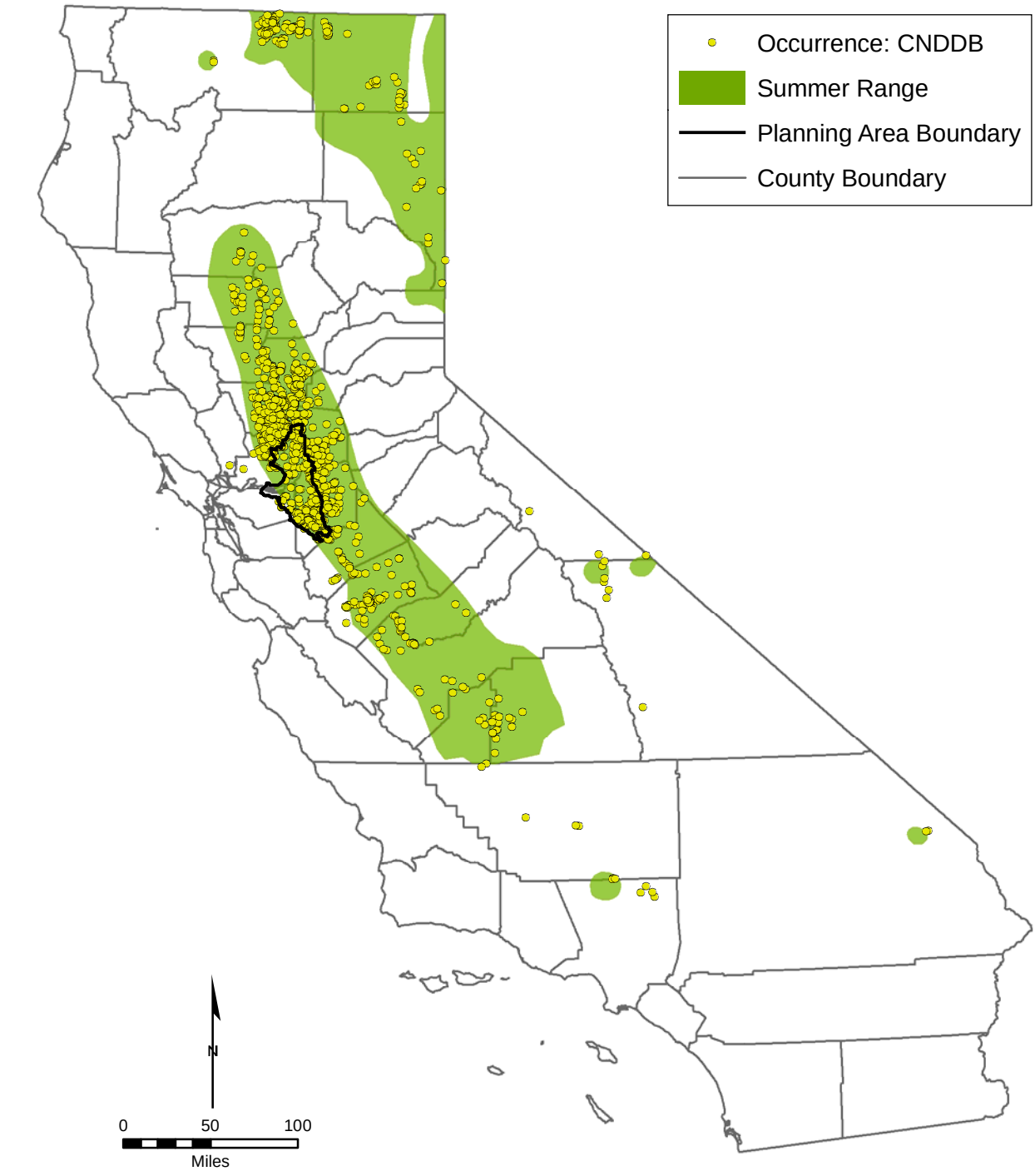
A.7.2 Species Distribution and Status

Range and Status

Swainson's hawks nest in the grassland plains and agricultural regions of western North America from southern Canada (and possibly in the northern provinces and territories, and Alaska) to northern Mexico. Other than a few documented small wintering populations in the United States (Herzog 1996, England et al. 1997), the majority of the species winters primarily in the Pampas region of Argentina. The Central Valley population winters mainly between Mexico and central South America (Bradbury et al. in preparation).

Early accounts described Swainson's hawk as one of the most common raptors in California, occurring throughout much of lowland California (Figure A.7.1) including the Central Valley, coastal valleys, southern California deserts, and Great Basin deserts east of the Sierra Nevada (Sharp 1902). Since the mid-1800s, native grassland foraging habitats and woodland nesting habitats that supported the species have undergone a gradual conversion to agricultural uses and urban uses. Today, native grassland habitats are virtually nonexistent in the state, and only remnants of the once vast riparian forests and oak woodlands still exist (Katibah 1983). While the species has successfully adapted to certain agricultural landscapes, this habitat loss has caused a substantial reduction in the breeding range and in the size of the breeding population in California (Bloom 1980; England et al. 1997). Current breeding populations occur primarily in the Central Valley, but also in the Klamath Basin, the northeastern plateau, Owen's Valley, and rarely in the Antelope Valley (Grinnell and Miller 1944, Bloom 1980, Garrett and Dunn 1981, Anderson et al. 2007).

Swainson's hawk populations have declined in California, Utah, Nevada, and Oregon (England et al. 1997). Populations in other western states are considered stable. Bloom (1980) reported a statewide estimate of 375 breeding pairs. This was followed by estimates of 550 (DFG 1988) in the late 1980s and 800 to 1,000 breeding pairs in the late 1990s (Swainson's Hawk Technical Advisory Committee). However, none of these estimates was generated using a statistically-based statewide survey effort and would be considered less credible than the results of a more statistically valid approach. The most recent statewide population estimate for California is 2,081 breeding pairs (Anderson et al. 2007) and is based on a statistically valid statewide survey effort conducted in 2005 and 2006. While this estimate is higher than the original statewide estimate that led to the state listing of the species (Bloom 1980) and subsequent estimates



Source: California Department of Fish and Game, WHR, 2006.
California Department of Fish and Game, CNDDB, 2008.

Figure A.7.1. Swainson's Hawk Statewide Range and Recorded Occurrences

through the 1980s and 1990s, it cannot be reliably used to measure trends. It does, however, represent a substantial decline (50 to 90 percent) of the historical statewide breeding population in California (Bloom 1980).

Nearly 94 percent of nesting Swainson's hawks in California are found in the Central Valley (an estimated 1,948 nesting pairs) (Anderson et al. 2007) from Tehama County south to Kern County. The majority of these are found in the middle section of the Central Valley between approximately Butte County on the north to Merced County on the south, where foraging and nesting habitat conditions are optimized. Over 60 percent of the statewide population occurs within Yolo, Sacramento, Solano, and San Joaquin Counties (Anderson et al. 2007). While intensively farmed for over 100 years, much of this area retains a relative abundance of nesting habitat – narrow riparian corridors along rivers and streams, remnant oak groves and trees, roadside trees – and an agricultural pattern that is conducive to Swainson's hawk foraging. Thus, the species is relatively common in the central portion of the Central Valley (Estep 2007, 2008, Anderson et al. 2007).

Distribution and Status in the Planning Area

Figure A.7.2 illustrates the nesting distribution of nesting Swainson's hawk in the BDCP Planning Area. These data are from recent survey efforts conducted in the Yolo and Sacramento County portions of the BDCP Planning Area (Estep 2007, 2008) and 2000 to 2007 data from the CNDDB (2008). A total of 314 nesting sites are identified on Figure A.7.2 from within the BDCP Planning Area. While the majority of these represent independent nesting territories, a few of the CNDDB locations may represent the same nesting territory in subsequent years. There is, however, a fairly dense nesting population occurring in the northern (north of State Route 12) and southern (south of State Route 4) portions of the BDCP Planning Area. These are areas that support a relative abundance of potential nesting habitat and an agricultural landscape that is suitable for Swainson's hawk foraging.

In the northern portion of the BDCP Planning Area, nest sites are distributed mainly east of the Deep Water Ship Channel and along the western edge of the BDCP Planning Area. These are areas that support mainly annually-rotated irrigated agricultural, hayfields, and irrigated pasturelands, and an abundance of potential nesting habitat, including riparian woodlands, roadside trees, tree rows, and isolated trees. The area immediately west of the Deep Water Ship Channel and the area immediately north of State Route 12 support few potential nest trees and thus fewer known nest sites.

Similarly, the area south of State Route 4 also supports a dense nesting population. The agricultural landscape in this area includes an abundance of alfalfa hay and annually rotated irrigated cropland and many potential nest trees, mostly along riparian corridors and roadside tree rows. Areas that lack nest sites, particularly the southernmost portion of the BDCP Planning Area south of Interstate 205, also lack sufficient nest trees to support many nesting pairs.

The Central Delta, the region between State Route 12 and State Route 4 supports fewer Swainson's hawk nests compared with the northern and southern regions (Figure A.7.2). The agricultural landscape in the Central Delta provides generally suitable foraging habitat for Swainson's hawks, although probably less high value cover types; but the lack of nest sites is likely primarily associated with the lack of suitable nest trees in this area. However, it should also be noted the survey effort in the Central Delta has not been as extensive as elsewhere in the plan area, and may contribute in part to the lack of reported nesting territories in that area.

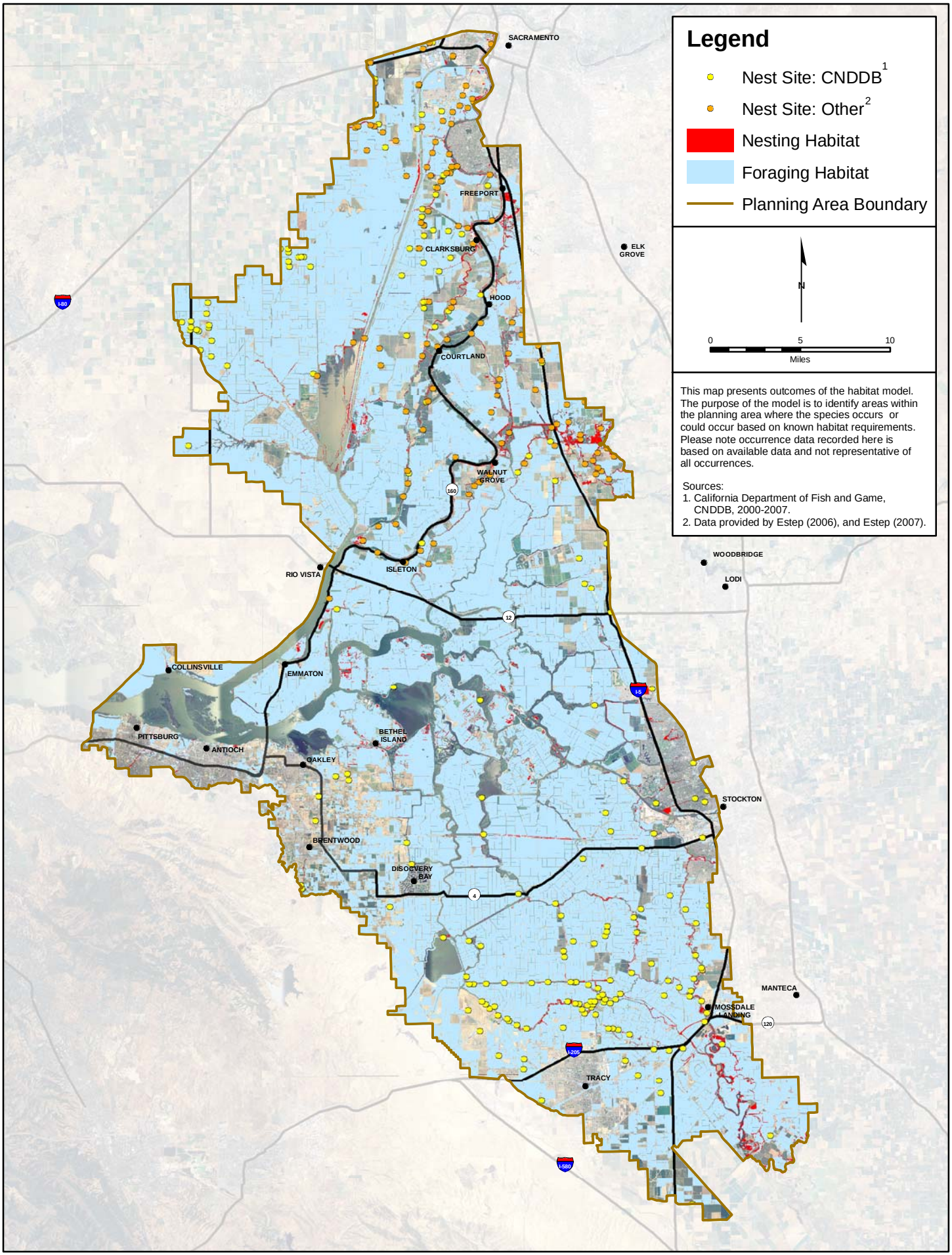


Figure A.7.2. Swainson's Hawk Habitat Model and Recorded Occurrences

A.7.3 Habitat Requirements and Special Conditions

Nesting. Throughout much of its range, both in North and South America, the Swainson's hawk inhabits grasslands, prairies, shrub-steppes, and agricultural landscapes—including dry and irrigated row crops, alfalfa and hay fields, pastures, and rangelands. They nest in trees most often in riparian woodlands and farm shelterbelts (England et al. 1997), as well as in urban/suburban areas with large trees adjacent to suitable foraging habitat (James 1992, England et al. 1995). Suitable nest trees are usually deciduous and tall (up to 100 feet); but in suburban/urban areas, most nest trees are conifers (England et al. 1995, 1997,). Nests are built of sticks sometimes several feet in diameter. They are generally placed in the uppermost and outermost branches that will support the nest, often in mistletoe clumps (England et al. 1997).

In the Central Valley, Swainson's hawks usually nest in large native trees such as valley oak (*Quercus lobata*), cottonwood (*Populus fremontia*), walnut (*Juglans hindsii*), and willow (*Salix* spp.), and occasionally in nonnative trees, such as eucalyptus (*Eucalyptus* spp.). Nests occur in riparian woodlands, roadside trees, trees along field borders, isolated trees, small groves, and on the edges of remnant oak woodlands. Stringers of remnant riparian forest along drainages contain the majority of known nests in the Central Valley (Estep 1984; Schlorff and Bloom 1984; England et al. 1997). However, this appears to be a function of nest tree availability rather than dependence on riparian forest. Nests are usually constructed as high as possible in the tree, providing protection to the nest as well as visibility from it.

Nesting pairs are highly traditional in their use of nesting territories and nesting trees. Many nest sites in the Central Valley have been occupied annually since 1979 and banding studies conducted since 1986 confirm a high degree of nest and mate fidelity (Estep in preparation).

Nesting habitat results from the 2006 and 2007 baseline surveys of South Sacramento County and Yolo County (Estep 2007, 2008) indicate that riparian habitat was the most frequently used nesting habitat type. Isolated trees, roadside trees, tree rows, farmyard trees, and rural residential trees were also frequently used. Valley oak and Fremont cottonwood were the most frequently used nest trees, followed by walnut, willow, and eucalyptus trees.

Foraging. Swainson's hawks are essentially plains or open-country hunters, requiring large areas of open landscape for foraging. Historically, the species used the grasslands of the Central Valley and other inland valleys. With substantial conversion of these grasslands to farming operations, Swainson's hawks have shifted their nesting and foraging into those agricultural lands that provide low, open vegetation for hunting and high rodent prey populations.

Foraging habitat value is a function of: (1) patch size (i.e., Swainson's hawks are sensitive to fragmented landscapes; use will decline as suitable patch size decreases); (2) prey accessibility (i.e., the ability of hawks to access prey depending on the vegetative structure and management activities); and (3) prey availability (i.e., the abundance of prey populations in a field). Data on minimum foraging patch size are largely anecdotal, but generally thought to be between two and 10 hectares (Estep and Teresa 1992, DFG 1994). In the Central Valley, agricultural land use or specific crop type determine the foraging value of a field at any given time. Cover types were evaluated by Estep (1989) and ranked based on these factors. However, suitability ranking is based on a variety of site-specific issues and at a landscape level should be characterized only on a general basis. On a site-specific level—important for land management purposes to maximize foraging value—individual cover types can be assessed based on site-specific and management conditions.

Important land cover or agricultural crops for foraging are alfalfa and other hay, grain and row crops, bare fallow fields, dryland pasture, and annual grasslands. The matrix of these cover types across a large area creates a dynamic foraging landscape as temporal changes in vegetation results in changing foraging patterns and foraging ranges.

Hay crops, particularly alfalfa, provide the highest value because of the low vegetation structure (high prey accessibility), relatively large prey populations (high prey availability), and because farming operations (e.g., weekly irrigation and monthly mowing during the growing season) enhances prey accessibility. Most row and grain crops are planted in winter or spring and have foraging value while the vegetation remains low, but become less suitable as vegetative cover and density increases. During harvest, vegetation cover is eliminated while prey populations are highest, significantly enhancing their suitability during this period. Some crop types, such as rice, orchards, and vineyards, provide little to no value because of reduced accessibility and relatively low prey populations.

A.7.4 Life History

Description. Swainson's hawk is a long-winged, medium-sized (19 to 22 inches and 1.5 to 3 pounds) soaring raptor that nests and roosts in large trees in flat, open grassland or agricultural landscapes. Females average larger than males, but there are no distinguishing plumage characteristics for separating the sexes.

Swainson's hawk is characterized by its long, narrow, and tapered wings held in flight in a slight dihedral shape. The body size is somewhat smaller, thinner, and less robust than other buteos, although the wings are at least as long as other buteos. This body and wing shape allows for efficient soaring flight and aerial maneuverability, important for foraging, which Swainson's hawks do primarily from the wing, and during courtship and inter-specific territorial interactions.

There are three definitive plumage morphs: light, rufous, and dark. However, there are numerous intermediate variations between these plumage morphs. The two most distinguishing plumage characteristics are a dark breast band and the contrasting darker flight feathers and lighter wing lings on the underwings giving most individuals a distinctive bicolored underwing pattern. These characteristics are most pronounced in lighter morph birds and become less so as the plumage darkens, and are indistinguishable in the definitive dark morph, which is completely melanistic. All three definitive plumage morphs are present in the Central Valley with a relatively large proportion of the population categorized as intermediate morph, with varying amounts of streaking or coloration in the belly and wing linings.

Seasonal Patterns. Swainson's hawks arrive on their breeding grounds in the Central Valley from early March to early April. The breeding season extends through mid-to-late August, when most young have fledged and breeding territories are no longer defended. By late August pre-migratory groups begin to form. The fall migration begins early- to mid-September. By early October, most Swainson's hawks have migrated out of the Central Valley. Central Valley Swainson's hawks winter primarily in Central Mexico and, to a lesser extent, throughout portions of Central and South America (Bradbury et al. in preparation). This differs from what is known about the migratory pattern and wintering grounds of Swainson's hawk populations outside of the Central Valley, most of which take a different migratory route and winter entirely in southern South America, with the largest wintering populations known to occur in northern Argentina (England et al. 1997).

Reproduction. Swainson's hawks exhibit a high degree of nest site fidelity, using the same nests, nest trees, or nesting stands for many years (England et al. 1997). Pairs are monogamous and may maintain bonds for many years (England et al. 1997). Immediately upon arrival onto breeding territories, breeding pairs begin constructing new nests or repairing old ones. One to four eggs are laid in mid- to late April followed by a 30 to 34 day incubation period. Nestlings begin to hatch by mid-May followed by an approximately 20-day brooding period. The young remain in the nest until they fledge in 38 to 42 days after hatching (England et al. 1997). Studies conducted in the Sacramento Valley indicate that one or two—and occasionally three—young typically fledge from successful nests (Estep in preparation). The rate of young fledged per nest in the Central Valley is among the lowest recorded in the entire species range. This geographic difference in reproductive success may be related to the reliance on small voles that may not meet the high energetic demands of breeding adults and developing young compared to the diets that include a higher proportion of gophers, rabbits, ground squirrels, and other larger mammals consumed in other locations. It may also be due to the energetic demands of foraging in a dynamic agricultural landscape that causes birds to travel long distances to forage during times when vegetative growth in agricultural fields reduces available foraging habitat near the nest. In Yolo County, fledging rates ranged from 1.15 to 1.96 young per successful nest from 1988 to 2000 (Estep in prep.).

After fledging, young remain near the nest and are dependent on the adults for about 4 weeks, after which they permanently leave the breeding territory (Anderson et al. in progress).

Home Range/Territory Size. Home ranges are highly variable depending on cover type, and fluctuate seasonally and annually with changes in vegetation structure (e.g., growth, harvest) (Estep 1989, Woodbridge 1991, Babcock 1995). Smaller home ranges consist of high percentages of alfalfa, fallow fields, and dry pastures (Estep 1989, Woodbridge 1991, Babcock 1995). Larger home ranges were associated with higher proportions of cover types with reduced prey accessibility, such as orchards and vineyards, or reduced prey abundance, such as flooded rice fields. Swainson's hawks regularly forage across a very large landscape compared with most raptor species. Data from Estep (1989) and England et al. (1995) indicate that it remains energetically feasible for Swainson's hawks to successfully reproduce when food resources are limited around the nest and large foraging ranges are required. Radio-telemetry studies indicate that breeding adults in the Central Valley routinely forage as far as 18.6 miles from the nest (Estep 1989, Babcock 1995).

Home ranges (calculated as minimum convex polygons) for 12 Swainson's hawks in the Central Valley averaged 10.7 mi^2 (range: 1.3 to 33.7 mi^2) (Estep 1989). Using similar methods, four Swainson's hawks in West Sacramento averaged 15.6 mi^2 (range: 2.8 to 29.6 mi^2), and included fields planted in grain, alfalfa, tomatoes, and safflower, as well as fallow fields (Babcock 1995).

Swainson's hawks in the central region of the Central Valley had the shortest distances between nests of those reported in England et al. (1997); on average, nests were 0.7 miles apart (Estep 1989). Results from a 2006 baseline survey of South Sacramento County indicate a nesting density of 14 pairs/100 km^2; and from a 2007 baseline survey of nesting Swainson's hawks in Yolo County, a nesting density within the survey area of 15 pairs/100 km^2, the highest nesting density reported for this species (Estep 2008). This high nest density was attributed to widely available, uniformly distributed optimal foraging habitat and relatively abundant nesting sites along narrow riparian corridors, farm shelterbelts, roadside trees, remnant groves, and isolated trees.

Foraging Behavior and Diet. Swainson's hawks hunt primarily from the wing, searching for prey from a low altitude soaring flight, 98 to 295 feet above the ground and attack prey by stooping toward the ground (Estep 1989). This species is also highly responsive to farming activities that expose and concentrate prey, such as cultivating, harvesting, and disking. During these activities, particularly late in the season, Swainson's hawks will hunt behind tractors searching for exposed prey. Other activities, such as flood irrigation and burning, also expose prey and attract foraging Swainson's hawks.

In the Central Valley, Swainson's hawks feed primarily on small rodents, usually in large fields that support low vegetative cover (to provide access to the ground) and high densities of prey (Bechard 1982; Estep 1989). These habitats include hay fields, grain crops, certain row crops, and lightly grazed pasturelands. Fields lacking adequate prey populations (e.g., flooded rice fields) or those that are inaccessible to foraging birds (e.g., vineyards and orchards) are rarely used (Estep 1989; Babcock 1995, Swolgaard 2003).

Meadow vole (*Microtus californicus*) is the principal prey item taken by Swainson's Hawks in the Central Valley (Estep 1989). Pocket gopher (*Thomomys bottae*) is also an important prey item. Other small rodents, including deer mouse (*Peromyscus californicus*) and house mouse (*Mus musculus*), are also taken along with a variety of small birds, reptiles, and insects.

A.7.5 Threats and Stressors

Swainson's hawks face different threats in different portions of their range. In California, causes of population decline are thought to be loss of nesting habitat (Schlorff and Bloom 1984) and loss of foraging habitat to urban development and to conversion to unsuitable agriculture, such as orchards and vineyards (England et al. 1995, 1997).

Conversion of agricultural lands to urban uses continues at a high rate throughout the range of the Swainson's hawk. Urbanization results in permanent loss of habitat and fragmentation of landscapes, which both result in a reduction of available foraging habitat for the Swainson's hawk.

Conversion from compatible to incompatible crop patterns also reduces available foraging habitat and influences the distribution of nesting Swainson's hawks. Large regions of the Central Valley that have been converted to rice, vineyards, orchards, cotton, and other incompatible crop types support few nesting Swainson's hawks. The continued conversion of suitable agricultural landscapes (e.g., annually rotated irrigated cropland, hayfields, and pasturelands) to vineyards and other unsuitable cover types continues to reduce available foraging habitat on local and regional basis.

Loss of riparian and other nesting habitat continues throughout the Central Valley from levee projects, agricultural practices, and local development along watercourses. A related issue is the loss and lack of regeneration of valley oak and other native trees. This is an ongoing problem in areas that have continued to support remnant valley oaks and oak groves. Nesting habitat continues to decline as these trees and small groves die off or are removed and are not replaced through natural regeneration or replanting.

Nestlings are vulnerable to starvation and fratricide (i.e., the larger nestling killing the smaller nestling in times of food-stress); predation from crows, ravens, and other raptors. Natural population cycles of voles in central California may be a major factor in reproductive success where vole population crashes suppresses reproduction or leads to increased starvation rates of nestlings. In addition, insecticides and rodenticides may contribute to these rates by reducing

prey abundance. There is little evidence that adult Swainson's hawks are killed by natural predators, but collisions with moving vehicles and illegal shooting and trapping have been identified as sources of mortality (England et al. 1997).

Well documented mass poisoning of hundreds or thousands of Swainson's hawks wintering in Argentina (Woodbridge et al. 1995, Goldstein et al. 1996) have led to that country's ban of an insecticide (organophosphate monocrotophos) used on alfalfa and sunflower fields to control grasshopper populations. Levels of DDE in Swainson's Hawks from the Central Valley may have been high enough to negatively affect reproductive success during the decades when it was used extensively in the United States. However, levels of DDE measured in eggs collected in 1982–1983 were not considered high enough to indicate a health threat (Risebrough et al. 1989).

A.7.6 Relevant Conservation Efforts

Conservation efforts have focused on the development and implementation of habitat conservation plans/natural community conservation plans. These regional conservation approaches can be an effective tool to managing and sustaining Swainson's hawk populations if sufficient suitable landscape is preserved (Estep and Teresa 1992). The majority of the BDCP Planning Area overlaps with other conservation planning efforts that are either currently being implemented (e.g., Contra Costa HCP/NCCP, San Joaquin County HCP) or are in development (e.g., Yolo County HCP/NCCP, Solano County HCP, South Sacramento County HCP). DFG is currently finalizing a management strategy for the Swainson's hawk that is designed to coordinate conservation planning efforts to facilitate a comprehensive and consistent approach to managing landscapes to sustain Swainson's hawk populations in the Central Valley (DFG in preparation).

The CALFED Bay-Delta Ecosystem Restoration Program Plan's Multi-Species Conservation Strategy (MSCS) designates the Swainson's hawk as "Contribute to Recovery" (CALFED Bay-Delta Program 2000). This means that CALFED will undertake actions under its control and within its scope that are necessary to recover the species. Recovery is equivalent to the requirements of delisting a species under federal and State ESAs.

A.7.7 Species Habitat Suitability Model

Nesting Habitat: Nesting habitat includes all valley riparian forests with a mature overstory component, including those dominated by white alder (*Alnus rhombifolia*), willow (*Salix* spp.), Oregon ash (*Fraxinus latifolia*), box elder (*Acer negundo*), walnut (*Juglans hinsii*), Fremont cottonwood (*Populus fremontii*), and valley oak (*Quercus lobata*). While valley oak and/or cottonwood-dominated riparian forests are considered optimal nesting habitat for this species, the model does not distinguish habitat quality according to overstory composition, tree density, or patch size. For purposes of this model, all mature overstory riparian is considered potential Swainson's hawk nesting habitat. Natural vegetation types designated as species habitat in this model correspond to the mapped vegetation associations in the BDCP GIS vegetation data layer.

Assumptions: In the Central Valley, Swainson's hawks typically nest in large native trees such as cottonwood, valley oak, and willow (Figure A.7.2). These trees (and thus most nest sites) are most often found along stringers of valley riparian forest (Estep 1984, Schlorff and Bloom 1984, England et al. 1997). However, Swainson's hawks also nest in a variety of other native (e.g., walnut, Oregon ash, box elder, white alder) and nonnative trees (e.g., eucalyptus [*Eucalyptus* spp.]) and habitats such as roadside trees, windbreaks, oak groves, isolated trees, and trees around rural residences. These nesting habitat types are not captured by this model primarily due

to the small mapping units that would be required, and thus potential nesting habitat is underestimated here (Figure A.7.2). While the model focuses on riparian habitats, to address this issue impact assessments will include all potential nesting habitat types where they occur in association with suitable foraging habitat.

Foraging Habitat: Foraging habitat includes all grassland types, all managed seasonal wetland types, all natural seasonal wetland types, all irrigated pastures and hays, and all seasonally rotated croplands. The model excludes suitable habitat fragments less than 40 acres in size if they are fragmented by urbanization. Suitable habitat fragmented by unsuitable agricultural crop types is not excluded. Agricultural crop types designated as species habitat correspond to DWR GIS land use database categories.

Assumptions: In the Central Valley, foraging habitat consists primarily of irrigated crop lands and pasturelands. Swainson's hawk also forage in annual grasslands and during the summer will occasionally use seasonal wetlands. Swainson's hawks feed primarily on small rodents, usually in large fields that support low vegetative cover (to provide access to the ground) and high densities of prey (Bechard 1982, Estep 1989). These habitats include hay fields, grain crops, certain row crops, and lightly grazed pasturelands. Fields lacking adequate prey populations (e.g., flooded rice fields) or those that are inaccessible to foraging birds (e.g., vineyards and orchards) are rarely used (Estep 1989, Babcock 1995, Swolgaard 2003) and are excluded here. Because foraging Swainson's hawks must have access to the ground, vegetative structure influences foraging use, which varies according to the crop type and seasonal planting and harvesting regime. However, because row and grain are seasonally rotated, the value of individual fields changes each year. Therefore, these crop types are not differentiated based on their seasonal value and are instead lumped together into a single category of seasonally rotated croplands. Foraging use is also a function of patch size. Foraging use generally decreases as field size decreases below approximately 40 acres. However, this is usually based on fragmentation of foraging habitat due to urbanization, and not necessarily by unsuitable crop types.

A.7.8 Recovery Goals

Recovery goals have not been established for this species.

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